Inforum Long-Run Modeling

Lift 2100

Ron Horst[1]

[1]Inforum - Department of Economics
University of Maryland

Inforum World Conference 2016, Osnabrück, Germany

Outline

Outline

Introduction to Inforum Long-Run Modeling Efforts

- Macro-InterIndustry Model
  - Horizon extended beyond typical 25-30 years (to 2100)
  - Consistency of structural model particularly useful
- Potential Uses
  - Energy & Climate Change, Alternative Technologies
  - Government Budgets: Retirement and Health, Policy Analysis, Test Consistency of External Forecast Assumptions
- Results
  - Indicators of government debt, program sustainability, employment requirements, carbon emissions, water usage, ...

Introduction to Inforum Long-Run Modeling Efforts

- Macro-InterIndustry Model
  - Horizon extended beyond typical 25-30 years (to 2100)
  - Consistency of structural model particularly useful
- Potential Uses
  - Energy & Climate Change, Alternative Technologies
  - Government Budgets: Retirement and Health, Policy Analysis, Test Consistency of External Forecast Assumptions
- Results
  - Indicators of government debt, program sustainability, employment requirements, carbon emissions, water usage, ...

Introduction to Inforum Long-Run Modeling Efforts

- Macro-InterIndustry Model
  - Horizon extended beyond typical 25-30 years (to 2100)
  - Consistency of structural model particularly useful
- Potential Uses
  - Energy & Climate Change, Alternative Technologies
  - Government Budgets: Retirement and Health, Policy Analysis, Test Consistency of External Forecast Assumptions
- Results
  - Indicators of government debt, program sustainability, employment requirements, carbon emissions, water usage, ...

Outline

Related Inforum Work

- Doug Nyhus. (2012). Long Term Health Spending and the Wider Economy.
- Meade, Horst, Werling, et al. (2009). The Balancing Act: Climate Change, Energy Security, and the U.S. Economy.
- Doug Nyhus. (2008). Alternate Scenarios with LIFT to Help Frame the Sustainability of Medicare Entitlements.

Related Inforum Work

- Doug Nyhus. (2012). Long Term Health Spending and the Wider Economy.
- Meade, Horst, Werling, et al. (2009). The Balancing Act: Climate Change, Energy Security, and the U.S. Economy.
- Doug Nyhus. (2008). Alternate Scenarios with LIFT to Help Frame the Sustainability of Medicare Entitlements.

Related Inforum Work

- Doug Nyhus. (2012). Long Term Health Spending and the Wider Economy.
- Meade, Horst, Werling, et al. (2009). The Balancing Act: Climate Change, Energy Security, and the U.S. Economy.
- Doug Nyhus. (2008). Alternate Scenarios with LIFT to Help Frame the Sustainability of Medicare Entitlements.

Related Inforum Work (Continued)

- R. Monaco, J. Phelps. (1996). Health Care Spending and the Rest of the Economy: A Short Look at the Long Term.
- T. Dowd, R. Monaco, J. Janoska. (1996). Effects of Future Demographic Changes on the U.S. Economy: Evidence from a Long-Term Simulation Model.
- R. Monaco, J. Janoska, T. Dowd, C. Scandlen. (1996). LIFT 2050: A Framework For Making Very Long-term Economic Projections, with Illustrations.

Related Inforum Work (Continued)

- R. Monaco, J. Phelps. (1996). Health Care Spending and the Rest of the Economy: A Short Look at the Long Term.
- T. Dowd, R. Monaco, J. Janoska. (1996). Effects of Future Demographic Changes on the U.S. Economy: Evidence from a Long-Term Simulation Model.
- R. Monaco, J. Janoska, T. Dowd, C. Scandlen. (1996). LIFT 2050: A Framework For Making Very Long-term Economic Projections, with Illustrations.

Related Inforum Work (Continued)

- R. Monaco, J. Phelps. (1996). Health Care Spending and the Rest of the Economy: A Short Look at the Long Term.
- T. Dowd, R. Monaco, J. Janoska. (1996). Effects of Future Demographic Changes on the U.S. Economy: Evidence from a Long-Term Simulation Model.
- R. Monaco, J. Janoska, T. Dowd, C. Scandlen. (1996). LIFT 2050: A Framework For Making Very Long-term Economic Projections, with Illustrations.

Other Related Work

- Congressional Budget Office (standard to 2026, long-run to 2046): Federal revenue and expenditure, economic
- Social Security Administration (2090): Retirement transfers, demographic, economic
- Centers for Medicare and Medicaid Services (2090): Health Spending, Health Transfers
- Energy Information Administration (2040): Energy prices, production, etc

Other Related Work

- Congressional Budget Office (standard to 2026, long-run to 2046): Federal revenue and expenditure, economic
- Social Security Administration (2090): Retirement transfers, demographic, economic
- Centers for Medicare and Medicaid Services (2090): Health Spending, Health Transfers
- Energy Information Administration (2040): Energy prices, production, etc

Other Related Work

- Congressional Budget Office (standard to 2026, long-run to 2046): Federal revenue and expenditure, economic
- Social Security Administration (2090): Retirement transfers, demographic, economic
- Centers for Medicare and Medicaid Services (2090): Health Spending, Health Transfers
- Energy Information Administration (2040): Energy prices, production, etc

Other Related Work

- Congressional Budget Office (standard to 2026, long-run to 2046): Federal revenue and expenditure, economic
- Social Security Administration (2090): Retirement transfers, demographic, economic
- Centers for Medicare and Medicaid Services (2090): Health Spending, Health Transfers
- Energy Information Administration (2040): Energy prices, production, etc

LIFT – A Current Long-Run Project

- Sponsored by the Centers for Medicare and Medicaid Services
- Build a Base Case projection to 2090
- Calibrate the Base Case to exogenous assumptions
  - Real GDP, GDP Inflation, Population, Labor Force, Unemployment, Health Spending, Health Transfer Payments
  - Other Exogenous: Energy Prices, Social Security Transfer Payments, Medicaid Transfers, Federal Spending, ...
- Review results, check consistency of exogenous assumptions
- Construct alternative cases, review implications of alternative assumptions

LIFT – A Current Long-Run Project

- Sponsored by the Centers for Medicare and Medicaid Services
- Build a Base Case projection to 2090
- Calibrate the Base Case to exogenous assumptions
  - Real GDP, GDP Inflation, Population, Labor Force, Unemployment, Health Spending, Health Transfer Payments
  - Other Exogenous: Energy Prices, Social Security Transfer Payments, Medicaid Transfers, Federal Spending, ...
- Review results, check consistency of exogenous assumptions
- Construct alternative cases, review implications of alternative assumptions

LIFT – A Current Long-Run Project

- Sponsored by the Centers for Medicare and Medicaid Services
- Build a Base Case projection to 2090
- Calibrate the Base Case to exogenous assumptions
  - Real GDP, GDP Inflation, Population, Labor Force, Unemployment, Health Spending, Health Transfer Payments
  - Other Exogenous: Energy Prices, Social Security Transfer Payments, Medicaid Transfers, Federal Spending, ...
- Review results, check consistency of exogenous assumptions
- Construct alternative cases, review implications of alternative assumptions

LIFT – A Current Long-Run Project

- Sponsored by the Centers for Medicare and Medicaid Services
- Build a Base Case projection to 2090
- Calibrate the Base Case to exogenous assumptions
  - Real GDP, GDP Inflation, Population, Labor Force, Unemployment, Health Spending, Health Transfer Payments
  - Other Exogenous: Energy Prices, Social Security Transfer Payments, Medicaid Transfers, Federal Spending, ...
- Review results, check consistency of exogenous assumptions
- Construct alternative cases, review implications of alternative assumptions

LIFT – A Current Long-Run Project

- Sponsored by the Centers for Medicare and Medicaid Services
- Build a Base Case projection to 2090
- Calibrate the Base Case to exogenous assumptions
  - Real GDP, GDP Inflation, Population, Labor Force, Unemployment, Health Spending, Health Transfer Payments
  - Other Exogenous: Energy Prices, Social Security Transfer Payments, Medicaid Transfers, Federal Spending, ...
- Review results, check consistency of exogenous assumptions
- Construct alternative cases, review implications of alternative assumptions

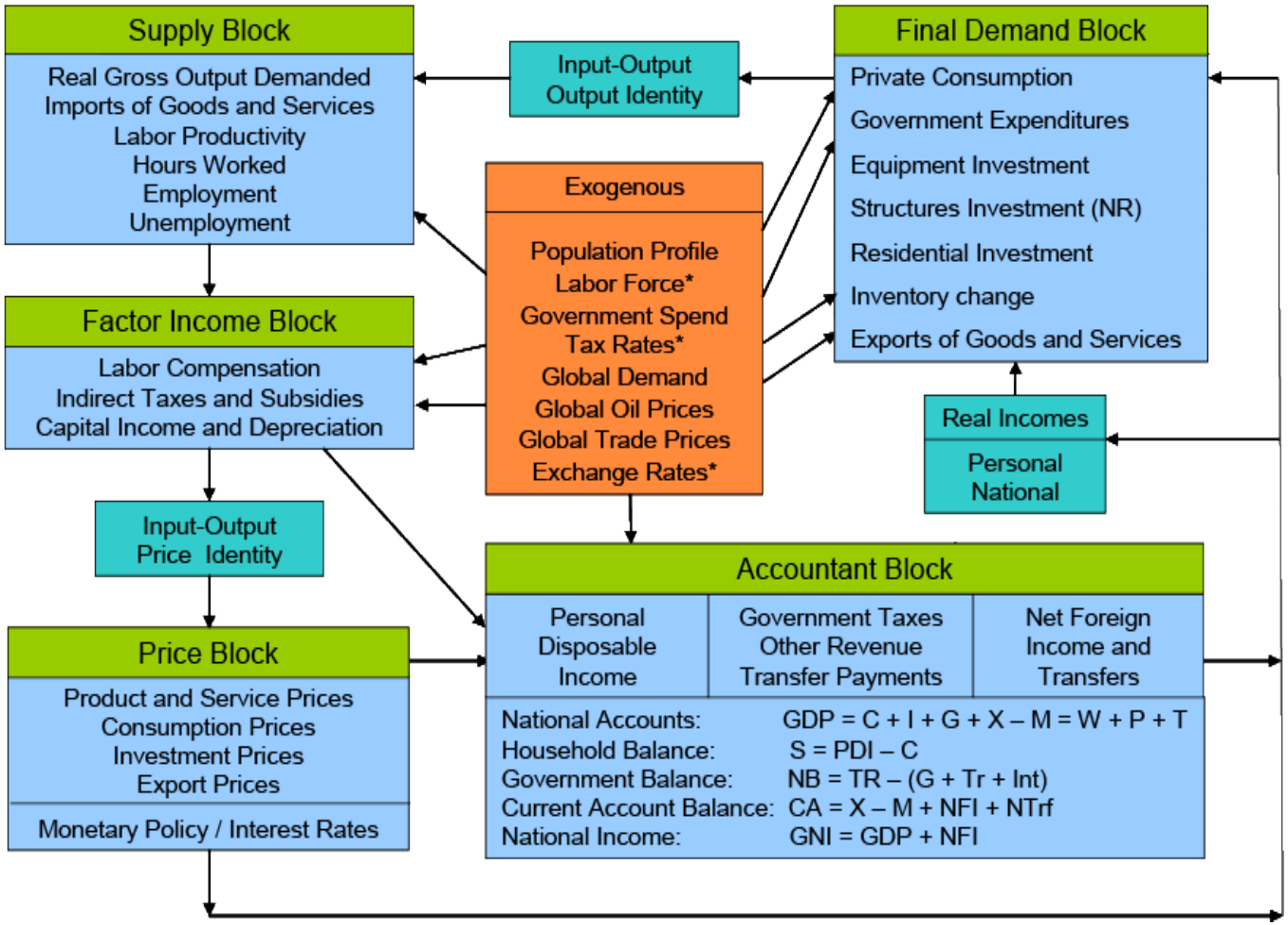
Project Goals

- Check consistency and feasibility of macroeconomic assumptions:
  - High spending in USA on health, and average age continues to rise
    - Nominal health spending grows (e.g.) at nominal GDP rate +1%
  - Health industry productivity growth slower than average
  - Implies rising health shares of GDP and employment
- Werling, Keehan, Nyhus, Heffler, Horst, Meade. (2014) The Supply Side of Health Care.
  - Determined economy-wide requirements of satisfying health care demand
  - This project also considers supply requirements

LIFT – Long-run Forecasting Tool

- 110 Commodities: Output, Prices, Final Demand
- 65 Industries: Employment, Productivity, Value Added, Equipment and Software Investment Purchasing
- 83 Personal Consumption Types
- 19 Private Construction Types
- Federal and State and Local Government: Consumption, Investment, Transfers, Revenue
- 110X110 A Matrix: Commodity by Commodity
- Full Macro Accounting: Real GDP, Inflation, Aggregate Productivity, Personal Income, ...

LIFT – A Diagram



LIFT – Adjustments for the Long Run

- Began with standard forecast to 2040
- Made initial A and bridge matrix extensions to 2100
- Extended fixes, used earlier work as guide for exogenous terms
- Ultimately smoothed matrix and other projections
- Ultimately revised 2015-2040 projections to correct problems and improve trajectories
- Main difficulty was the extension itself (smooth and plausible trajectories); process otherwise similar to standard forecasting

LIFT – Adjustments for the Long Run

- Began with standard forecast to 2040
- Made initial A and bridge matrix extensions to 2100
- Extended fixes, used earlier work as guide for exogenous terms
- Ultimately smoothed matrix and other projections
- Ultimately revised 2015-2040 projections to correct problems and improve trajectories
- Main difficulty was the extension itself (smooth and plausible trajectories); process otherwise similar to standard forecasting

LIFT – Adjustments for the Long Run

- Began with standard forecast to 2040
- Made initial A and bridge matrix extensions to 2100
- Extended fixes, used earlier work as guide for exogenous terms
- Ultimately smoothed matrix and other projections
- Ultimately revised 2015-2040 projections to correct problems and improve trajectories
- Main difficulty was the extension itself (smooth and plausible trajectories); process otherwise similar to standard forecasting

LIFT – Adjustments for the Long Run

- Began with standard forecast to 2040
- Made initial A and bridge matrix extensions to 2100
- Extended fixes, used earlier work as guide for exogenous terms
- Ultimately smoothed matrix and other projections
- Ultimately revised 2015-2040 projections to correct problems and improve trajectories
- Main difficulty was the extension itself (smooth and plausible trajectories); process otherwise similar to standard forecasting

Outline

Lift Calibration

1. Fix purely exogenous features: Personal Health Spending, Health & Retirement Tranfer Payments, Energy Prices, ...
2. Real GDP Target: Adjust real final demand growth.
3. Unemployment Rate Target: Adjust productivity growth.
4. GDP Inflation: Adjust wage rates, profits, capital consumption.
5. Go To #2, repeat as necessary until all objectives hold simultaneously.

Consumption Assumption

- 10-Year projections: PCE quantities and prices for Health Care goods, services, insurance.
- 75-Year projections: Nominal total health spending (mainly PCE), assumption about Price-Real split.
- PCE Health Care Quantities and Prices thus largely exogenous.

Consumption Assumption

- 10-Year projections: PCE quantities and prices for Health Care goods, services, insurance.
- 75-Year projections: Nominal total health spending (mainly PCE), assumption about Price-Real split.
- PCE Health Care Quantities and Prices thus largely exogenous.

Consumption Assumption

- 10-Year projections: PCE quantities and prices for Health Care goods, services, insurance.
- 75-Year projections: Nominal total health spending (mainly PCE), assumption about Price-Real split.
- PCE Health Care Quantities and Prices thus largely exogenous.

Outline

Consistency

- Model: Industry Revenue→Nominal Output→Output Price →Final Demand Price
- Model: Imposed Final Demand Price→↛Output Price→Nominal Output→Industry Revenue (by adjusting industry profits)
- Health Care Prices: Model does not enforce consistency between imposed PCE prices and output prices. Health industry revenue not consistent with spending.
- Health Services Commodities (A Special Case): little/no trade, output driven mainly/entirely by real PCE Health.

Consistency

- Model: Industry Revenue→Nominal Output→Output Price →Final Demand Price
- Model: Imposed Final Demand Price↛Output Price→Nominal Output→Industry Revenue (by adjusting industry profits)
- Health Care Prices: Model does not enforce consistency between imposed PCE prices and output prices. Health industry revenue not consistent with spending.
- Health Services Commodities (A Special Case): little/no trade, output driven mainly/entirely by real PCE Health.

Consistency

- Model: Industry Revenue→Nominal Output→Output Price →Final Demand Price
- Model: Imposed Final Demand Price↛Output Price→Nominal Output→Industry Revenue (by adjusting industry profits)
- Health Care Prices: Model does not enforce consistency between imposed PCE prices and output prices. Health industry revenue not consistent with spending.
- Health Services Commodities (A Special Case): little/no trade, output driven mainly/entirely by real PCE Health.

Consistency

- Model: Industry Revenue→Nominal Output→Output Price →Final Demand Price
- Model: Imposed Final Demand Price↛Output Price→Nominal Output→Industry Revenue (by adjusting industry profits)
- Health Care Prices: Model does not enforce consistency between imposed PCE prices and output prices. Health industry revenue not consistent with spending.
- Health Services Commodities (A Special Case): little/no trade, output driven mainly/entirely by real PCE Health.

Consistency

- Output Prices: Attempted to impose (growth) consistency for health services commodity prices (a special case). Output prices a function of output, imports, real consumption, consumption prices, import prices, bridge coefficients.
- Start with nominal supply = nominal demand. Derive for commodity price p_j

$$p_j^q = \frac{q_j + m_j}{q_j} \times \frac{\sum_{h \forall H} B_{j,h} \times c_h \times p_h^c}{\sum_{h \forall H} B_{j,h} \times c_h} - \frac{m_j}{q_j} \times p_j^m$$

- Derivation and details to follow. Needs review.

Consistency

- Output Prices: Attempted to impose (growth) consistency for health services commodity prices (a special case). Output prices a function of output, imports, real consumption, consumption prices, import prices, bridge coefficients.
- Start with nominal supply = nominal demand. Derive for commodity price p_j

$$p_j^q = \frac{q_j + m_j}{q_j} \times \frac{\sum_{h \forall H} B_{j,h} \times c_h \times p_h^c}{\sum_{h \forall H} B_{j,h} \times c_h} - \frac{m_j}{q_j} \times p_j^m$$

- Derivation and details to follow. Needs review.

Outline

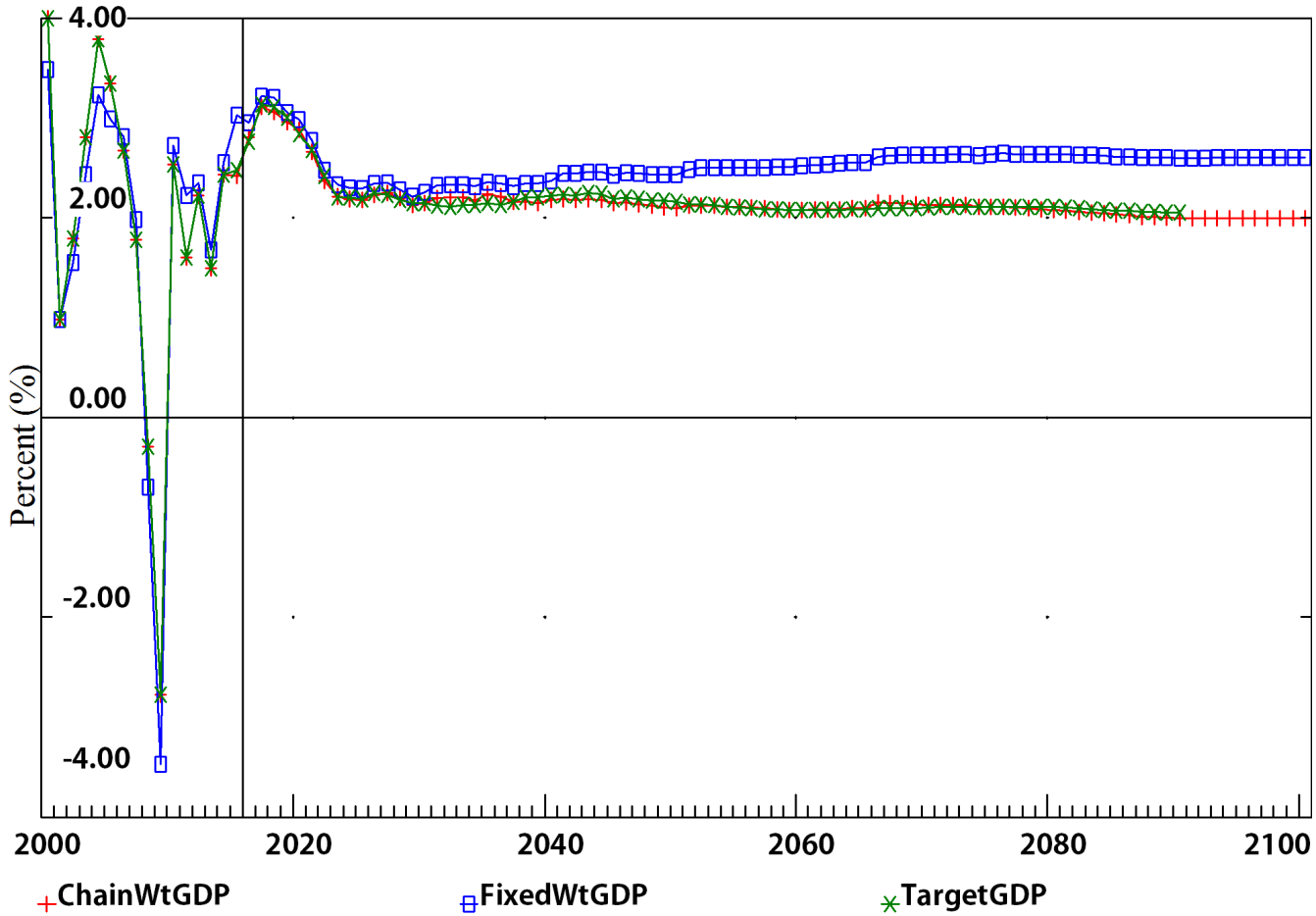
Fixed Weights vs Chain Weights

- Aggregation methods matter. Persistent difference can exist in growth rates.
- Consistency in mapping model variables to the exogenous targets is crucial. For example,
  - Chain-Weighted Real GDP growth
  - Chain-Weighted GDP inflation
  - Overall Productivity Growth: Chain-Weighted Real GDP / Hours

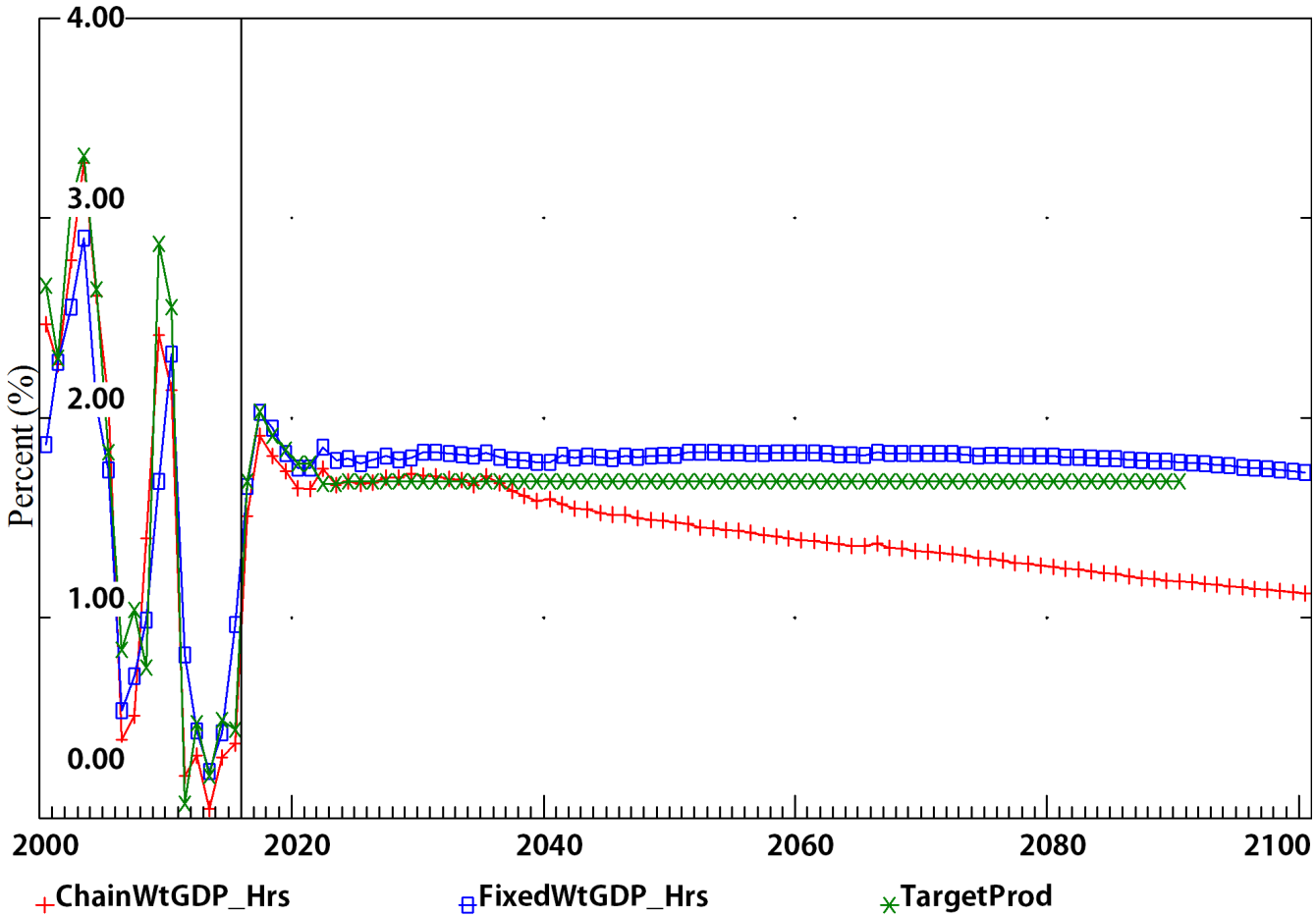
Fixed Weights vs Chain Weights

- Aggregation methods matter. Persistent difference can exist in growth rates.
- Consistency in mapping model variables to the exogenous targets is crucial. For example,
  - Chain-Weighted Real GDP growth
  - Chain-Weighted GDP inflation
  - Overall Productivity Growth: Chain-Weighted Real GDP / Hours

Fixed Weights vs Chain Weights: GDP



Fixed Weights vs Chain Weights: Productivity



Evaluation

- Hit the required targets and satisfy exogenous details.
- GDP consistent with Potential GDP, Unemployment Rate with Natural Rate. Inflation and saving rate stable.
- Plausible government debt levels and current account balances.
- Stable nominal final demand and factor income shares. (??)
- Other...?

Evaluation: Nominal Final Demand Shares

	1978	2000	2010	2015	2016	2030	2060	2080	2100
Personal Consump Expenditures	62.2	68.6	70.5	70.4	69.9	69.5	69.6	70.6	73.0
Nonresidential Fixed Investment	12.2	12.7	9.2	10.8	10.8	11.1	10.9	11.3	11.9
Residential Investment	5.7	4.5	2.3	3.2	3.5	4.2	4.4	4.5	4.7
Inventory Change	1.1	0.5	0.4	0.7	0.5	0.3	0.5	0.5	0.4
Net Exports	-1.1	-3.8	-3.5	-2.6	-2.7	-0.7	-0.9	-3.1	-7.1
Government	19.8	17.4	21.1	17.6	17.3	15.8	16.9	17.6	18.1
Residual	0.0	0.0	0.0	-0.1	0.7	-0.1	-1.4	-1.4	-0.9

Evaluation: Factor Income Shares

	2000	2010	2015	2016	2030	2060	2080	2100
Labor compensation	58.2	55.0	55.1	55.1	56.0	58.5	61.1	62.2
Taxes on production and imports, less subsidies	6.7	6.9	7.0	6.9	7.1	7.1	7.1	7.2
Gross operating surplus	36.5	37.9	38.6	38.0	36.9	34.3	31.8	30.8

Conclusions

- Substantial progress on baseline projections to 2100
- Correction needed for productivity growth
- Adjustments needed for factor income, final demand, other details
- Identification and evaluation of additional criteria

Additional Resources I

- See Research, Models, and Policy Analysis pages on www.Inforum.umd.edu.
- Meade, Horst, Werling, et al. (2009). The Balancing Act: Climate Change, Energy Security, and the U.S. Economy. businessroundtable.org/studies-and-reports/the-balancing-act-climate-change-energy-security-and-the-u.s.-economy.
- R. Monaco, J. Phelps. (1996). Health Care Spending and the Rest of the Economy: A Short Look at the Long Term. www.inforum.umd.edu/papers/wp/wp/1996/wp96010.pdf.

Additional Resources II

- T. Dowd, R. Monaco, J. Janoska. (1996). Effects of Future Demographic Changes on the U.S. Economy: Evidence from a Long-Term Simulation Model.
  www.inforum.umd.edu/papers/wp/wp/1996/wp96009.pdf.
- R. Monaco, J. Janoska, T. Dowd, C. Scandlen. (1996). LIFT 2050: A Framework For Making Very Long-term Economic Projections, with Illustrations.
  www.inforum.umd.edu/papers/wp/wp/1996/wp96001.pdf.
- Werling, Keehan, Nyhus, Heffler, Horst, Meade. (2014) The Supply Side of Health Care.
  www.inforum.umd.edu/services/projects/supplysideofhealthcare.html.

Additional Resources III

Author contact:

horst@econ.umd.edu.